



U.S. Department of Energy
Energy Efficiency and Renewable Energy

Federal Energy Management Program

Biomass & Methane Fuels as an Alternative Energy Solution

Christopher Abbuehl

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TOPICS

- FEMP & BAMF Programs
- Resources and Technologies
- Example Projects
- Benefits and Challenges
- Project Assistance



Federal Energy Management Program (FEMP) Objectives

- ✦ Reduce building energy use 35% by 2010
- Reduce greenhouse gas emissions 30% below 1990 levels by 2010
- Demonstrate energy technology (showcases)
- Use innovative financing & contract mechanisms



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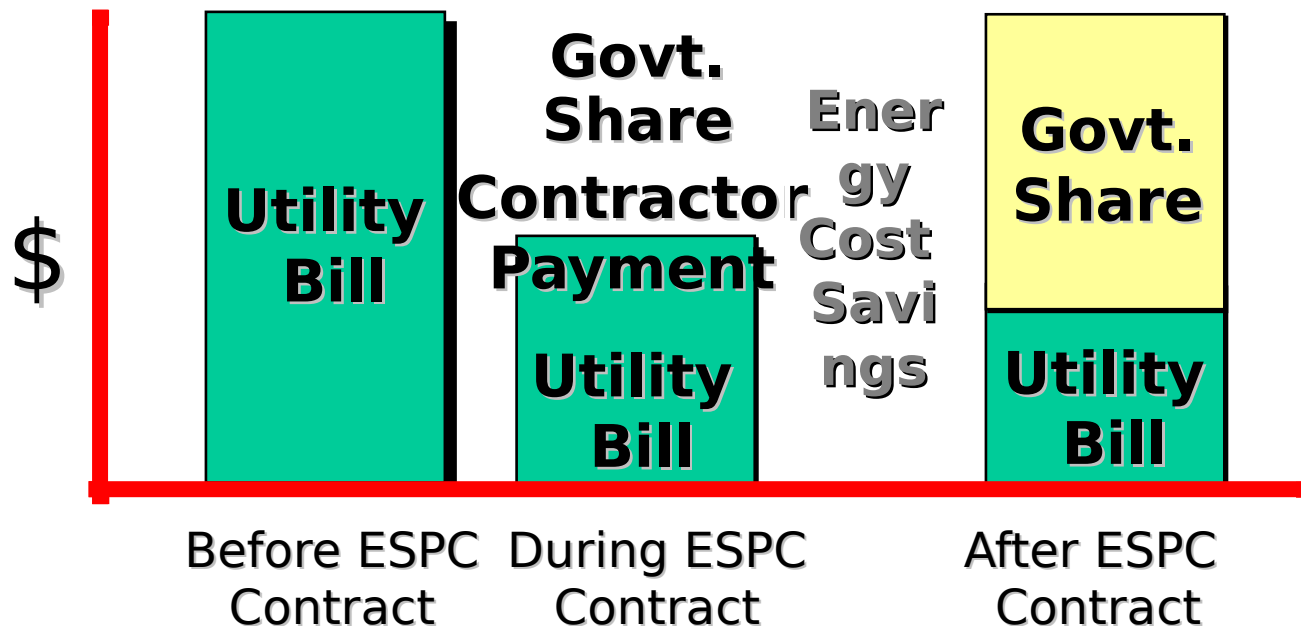
Key Elements of Super ESPC's

- ◆ No capital appropriations required
- Energy savings guarantee by ESCO insures system performance
- Streamlined contract process
- Approximately \$1 billion in capital improvements





Basic Concept of ESPC Financing



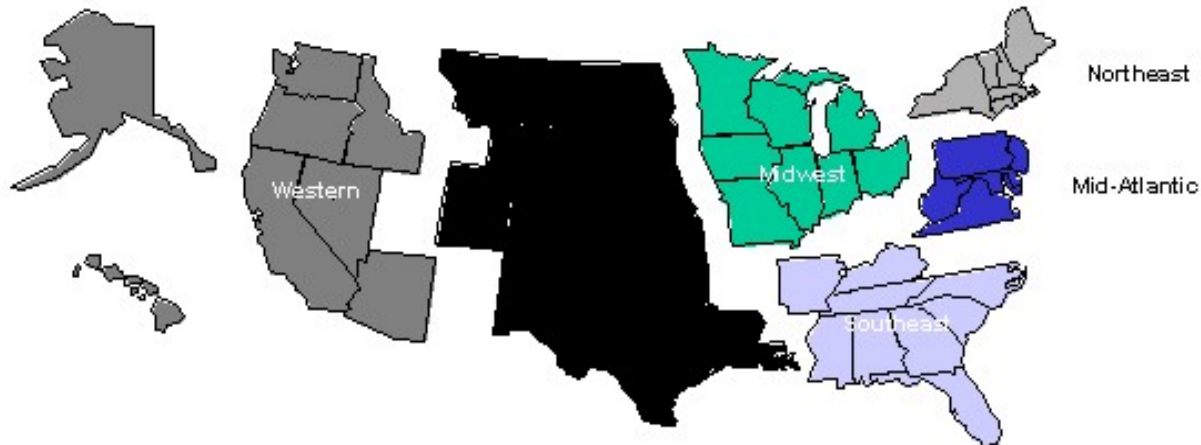


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Types of DOE Super ESPC's

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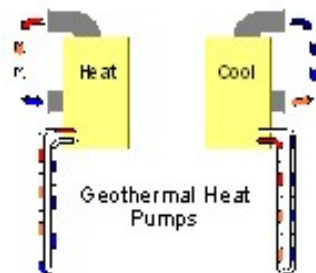
Super ESPC Regions



Technology-Specific Super ESPC



Solar and
Photovoltaics



Biomass



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Biomass Super ESPC

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Biomass and Alternative Methane Fuels (BAMF) Basic Features

- ❖ Involve a BAMF Resource
- ❖ Federal Facility
- ❖ One of selected ESCO's
- ❖ Anywhere worldwide
- ❖ Contract & technical support by NETL



ESCO's Awarded IDIQ Contracts

- Ameresco Federal Solutions
- Constellation Energy Source
- DTE Biomass Energy, Inc.
- Energy Systems Group
- Honeywell Energy Services



BAMF Legislative Drivers

- EO-13123, "Greening the Government Through Efficient Energy Management," requires Federal agencies to reduce energy use in Federal buildings by 35% from 1985 levels by 2010.
- EO-13134, "Developing and Promoting Biobased Products and Bioenergy," seeks to stimulate the creation and early adoption of technologies needed to make bioenergy cost competitive in large



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Biomass Resources

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Woodwaste



- Forest Clearing
- Lumber Companies
- Furniture Industry
- Landscape Trimming

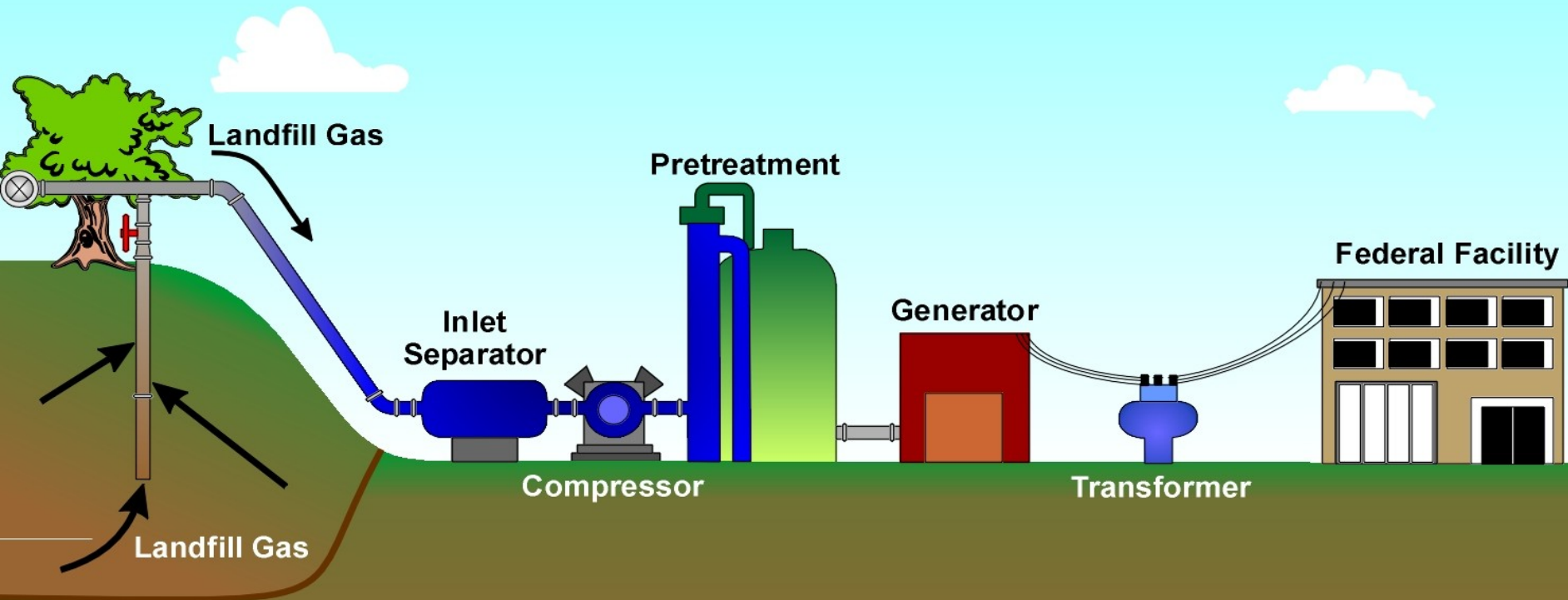


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Biomass Resources

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Landfill Gas





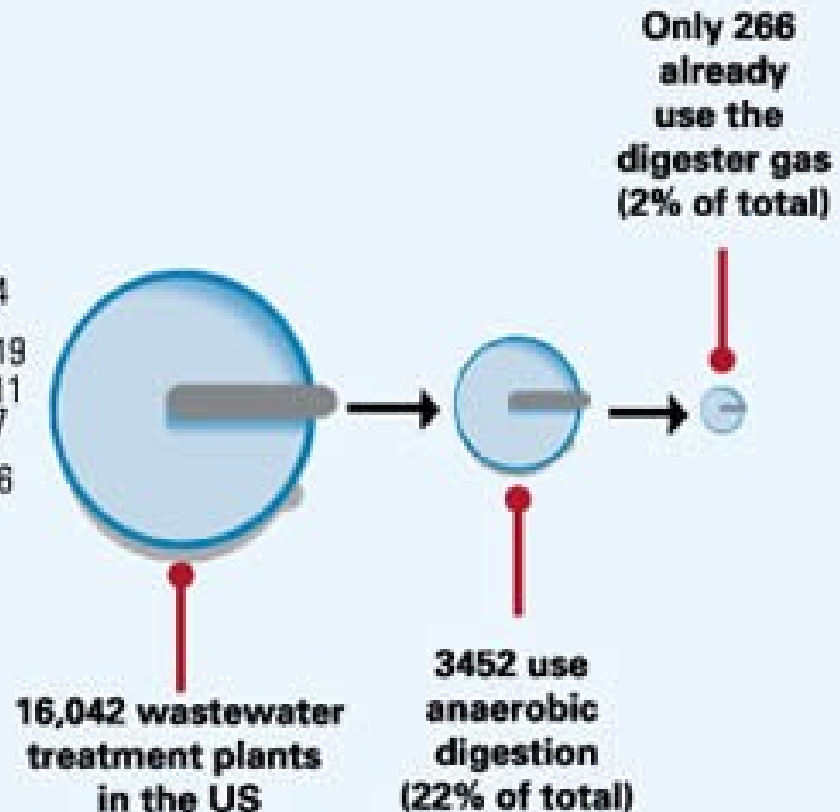
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Digester Gas -Wastewater Treatment Plants

Geographic distribution of wastewater treatment plants using anaerobic digestion





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Dedicated Crops



- Grasses - Switchgrass
- Fast growing trees - Hybrid poplar, willow
- Corn, soybeans (ethanol, bio-diesel)



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Biomass Resources

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Agriculture



Corn stover, Rice hulls
Sugarcane bagasse
Animal biosolids

Industry



Food Processing
Chemical Industry
Coal mines



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Technologies

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Direct Combustion & Co-

Installed
Capacity
7,800 MW



Power
Range
2-100 MW

Cost per KW
\$1,000 - 1,500

Power Efficiency
20-25%



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Technologies

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Gasification – Turbines (Steam &

Installed
Capacity
1,500 MW



Power
Range
5–50 MW

Cost per KW
\$1,800 – 2,000

Power Efficiency
30-40%



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Technologies

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Diesel & IC Engines

Installed
Capacity
650 MW



Power
Range
.2 - 5 MW

Cost per KW
\$700 - 1,500

Power Efficiency
25-35%



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Technologies

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Microturbines



Power Range	30-250 KW
Cost per KW	\$2,000
Power Efficiency	20 -30%

Cell

Power Range	5-250 KW
Cost per Kwh	\$5,000
Power Efficiency	30-50

Fuel



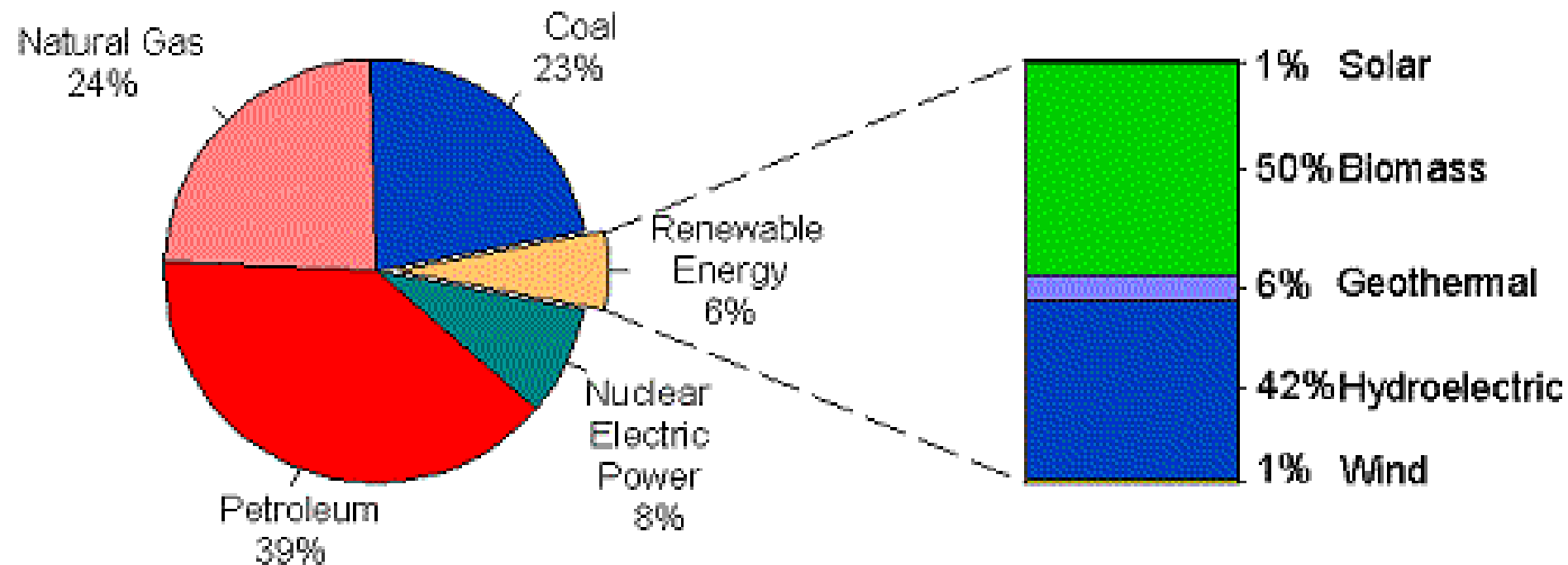


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US Energy Production

Total = 96.935 Quadrillion Btu

Total = 5.668 Quadrillion Btu





Example Project

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Hill Air Force Base, Utah

Electricity

- Two 600 KW engines
- Pipeline 2.1 miles
- 20 year contract
- Partners with Davis County, Utah Power
- Financed by ESPC

Landfill Gas to

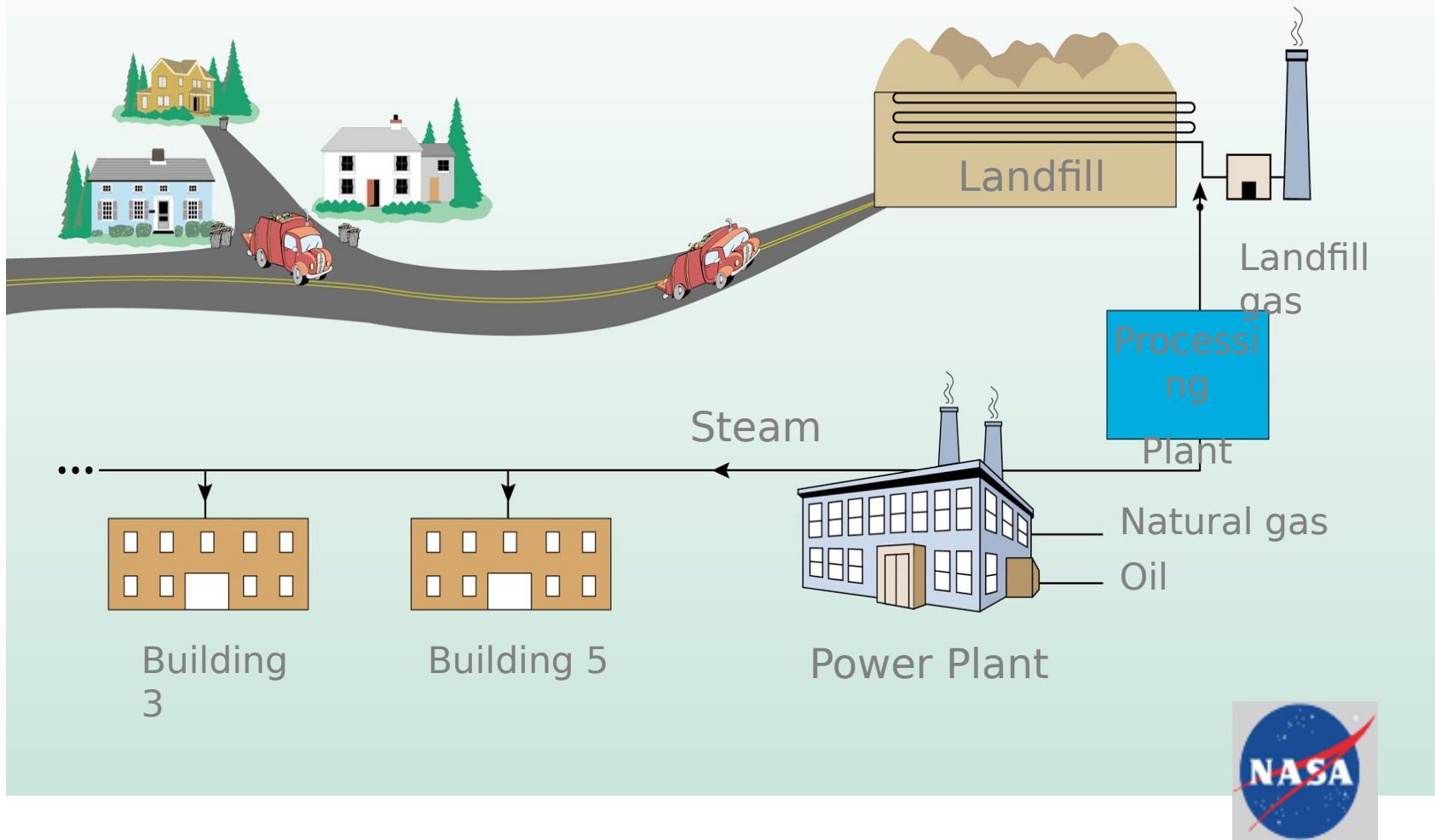




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Example Project

NASA Goddard Space Flight Center





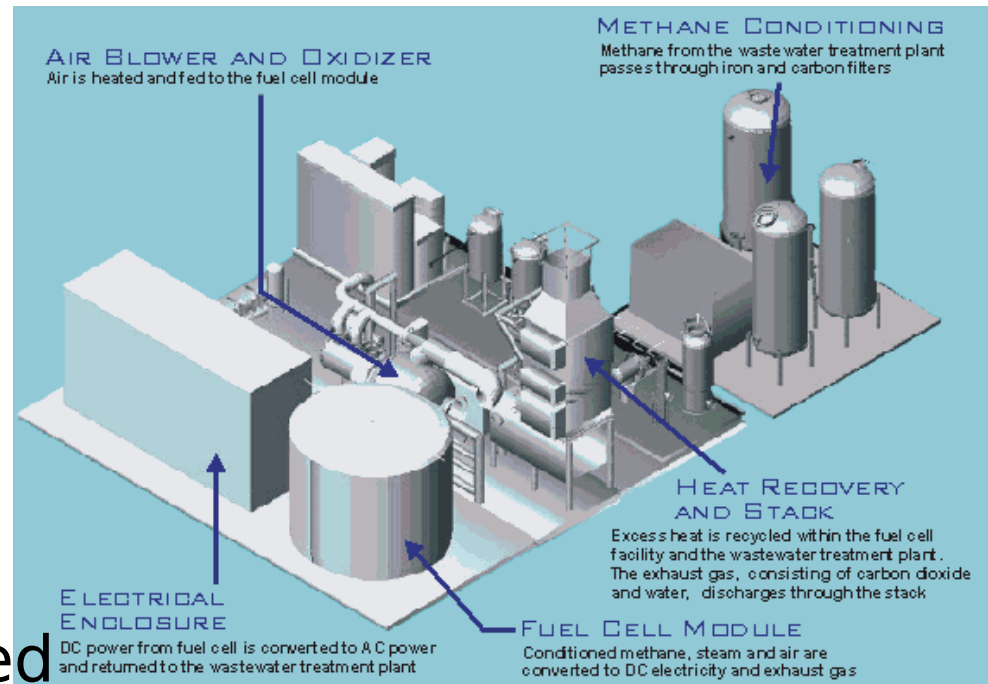
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King County Wastewater Treatment Plant,



Renton, WA

- One MW Fuel Cell
- Digester Gas Fueled
- Larger cogen planned





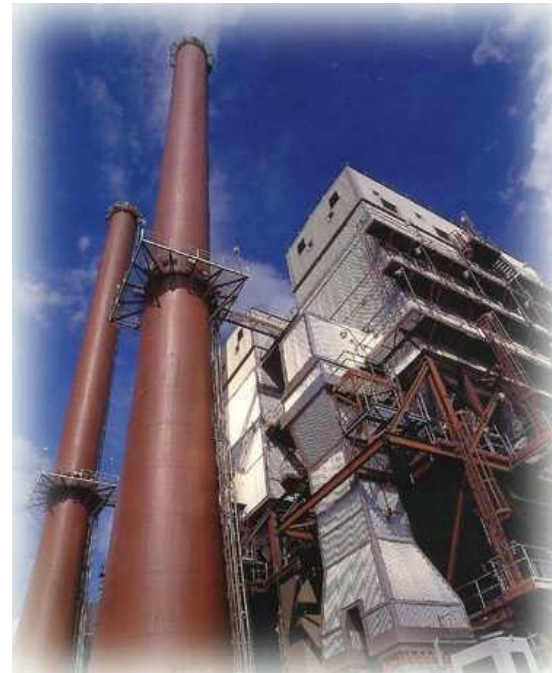
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MSW to Energy

Norfolk Naval

Shipyard

- CHP in operation since 1987
- 100% shipyard heat 75% electric
- 2000 tons MSW per day
- 4 boilers rated at 180,000 lb/hr
- 3 electric turbines at 20mw each





Example Projects

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TVA Colbert Alabama

- Supplements coal-fired boilers with biomass
- Potential Cost Savings of \$1.5 Million/year
- 10% reduction in SO₂ emissions*
- 10% reduction in net CO₂ emissions*
- Up to 14% reduction in NO_x emissions

Woodwaste Co-firing





Example Projects

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Coal Mine Methane Project

Federal Co. Mine, W VA

- ❖ 500,000 cf gas/day
- ❖ 1.2 MW electric
- ❖ 18 IC engines 75kw/each
- ❖ Coal Mines captured
 - 14 bcf in 1990
 - 36 bcf in 2000





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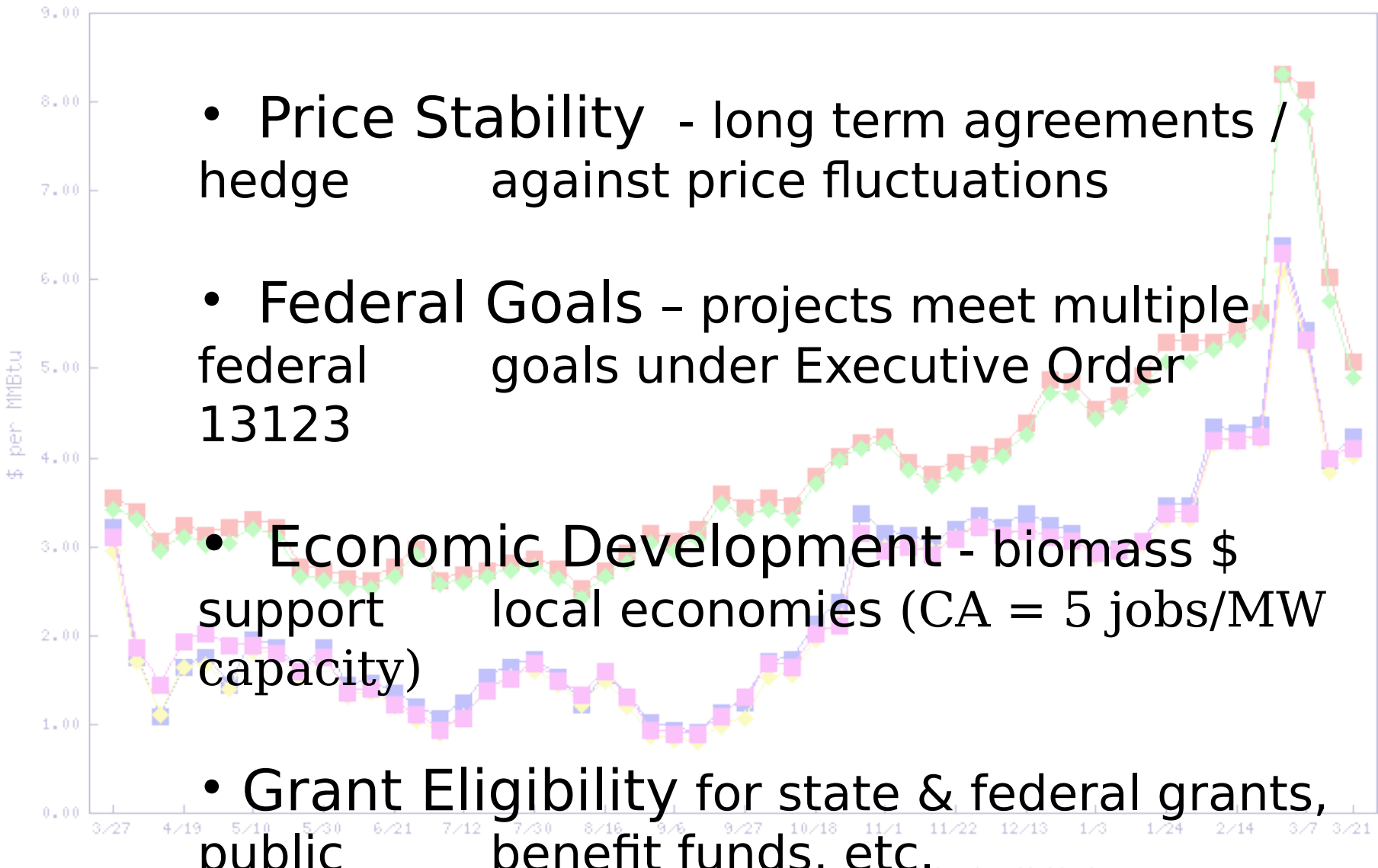
- ❖ Energy Security – systems capable of being grid independent
- ❖ Reduced dependence - on fossil fuels and foreign imports
- ❖ System Design
 - Established - 1000's in operation
 - High availability/capacity
 - Energy stored and dispatched



Project Benefits

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NGI's Weekly Gas Price Index





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Lowest Cost Fuel Supply

Because waste gases from landfills, wastewater treatment plants and coal mines are byproducts of some other primary business.

Same with agricultural crops and wastewood. For example, millions of tons of biomass will either fuel wildfires or be removed as part of Forest Service / BLM Stewardship programs.



Legal

- ❖ Fuel Supply Agreements
- ❖ Power Purchase Agreements
- ❖ Standby power agreement
- ❖ Outside third party





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Project Challenges

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Technical

- ❖ Right of Ways
- ❖ Utility Interconnect
- ❖ Environmental Permits
- ❖ O&M Responsibility





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Project Assistance

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DOE Lab Technical Assistance

- ❖ NREL - Ad Hoc Studies
- ❖ ORNL - CHP Screenings
- ❖ NETL - BAMF Resource Assessments

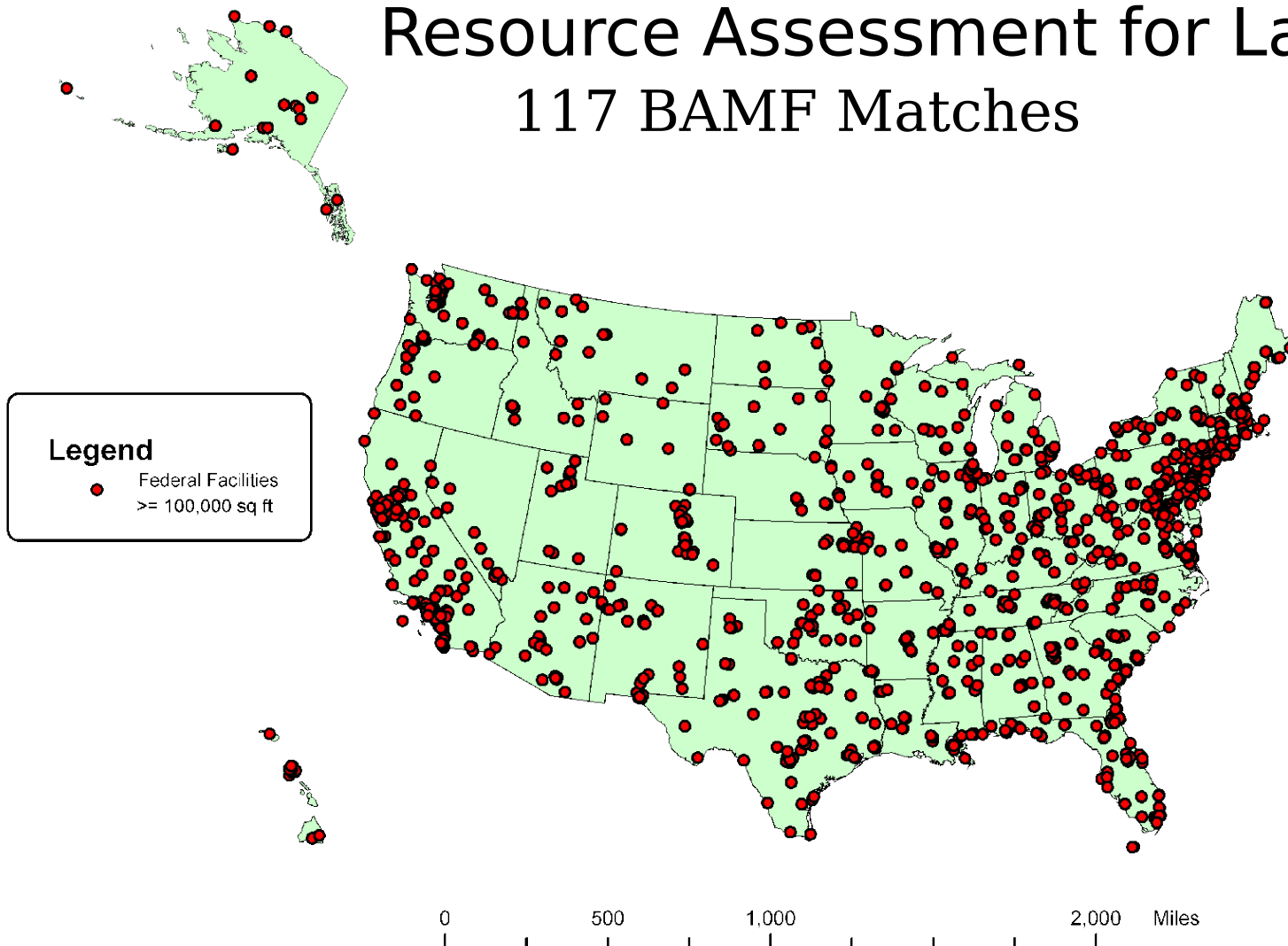


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Project Assistance

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Resource Assessment for Landfills 117 BAMF Matches





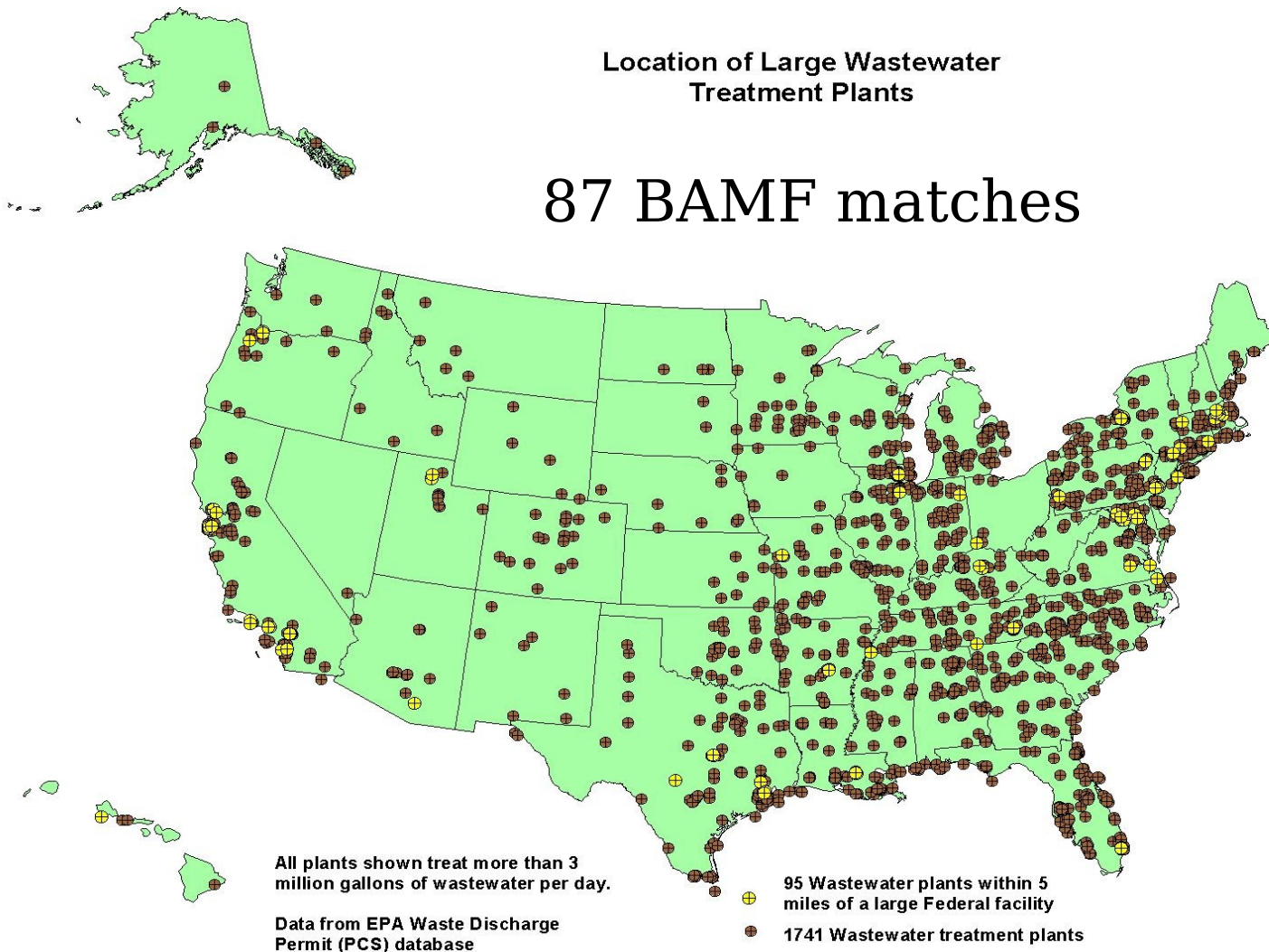
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Location of Large Wastewater
Treatment Plants

87 BAMF matches

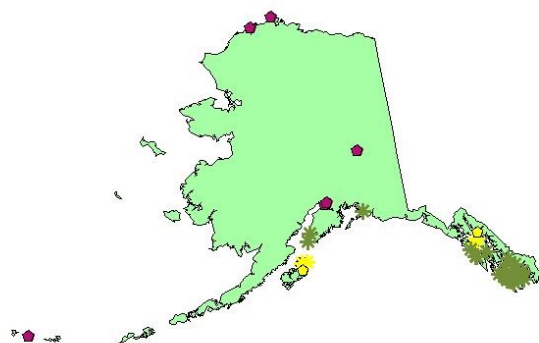




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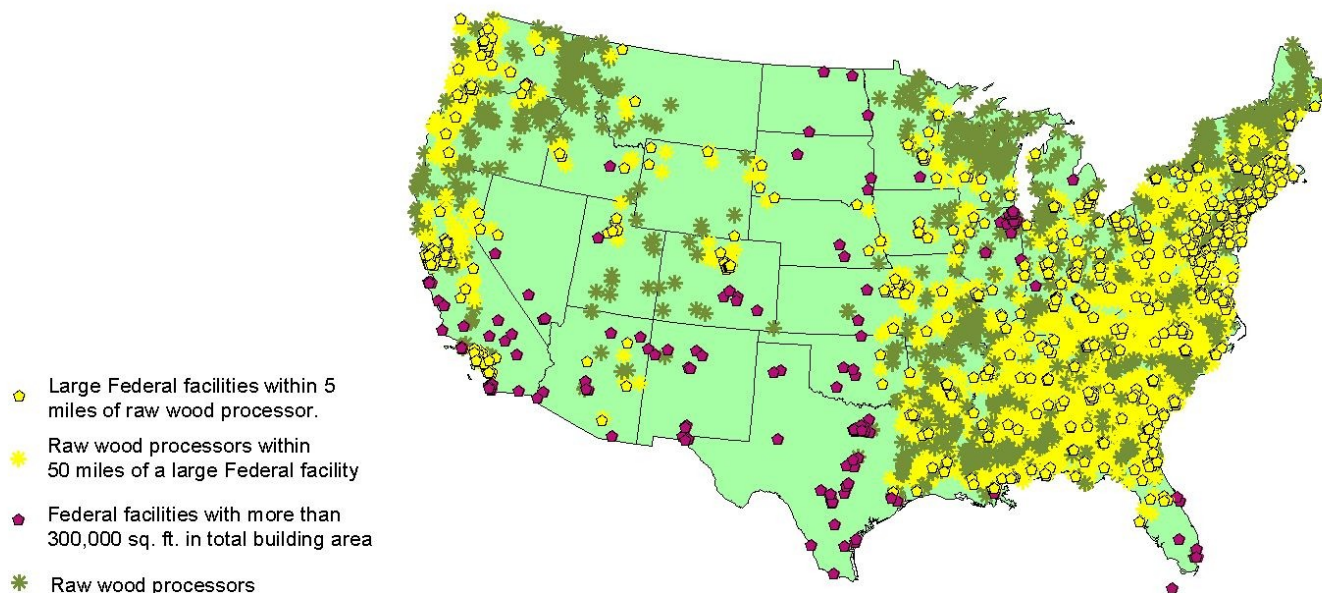
Project Assistance

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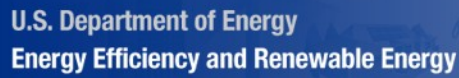
Proximity of Large Federal Facilities
to Raw Wood Processors

751 BAMF Matches



- Yellow pentagon: Large Federal facilities within 5 miles of raw wood processor.
- Yellow star: Raw wood processors within 50 miles of a large Federal facility
- Purple pentagon: Federal facilities with more than 300,000 sq. ft. in total building area
- Green star: Raw wood processors

813 of 1015 large Federal facilities are located within 50 miles of 2296 raw wood processors



Conclusion

- [illegible]